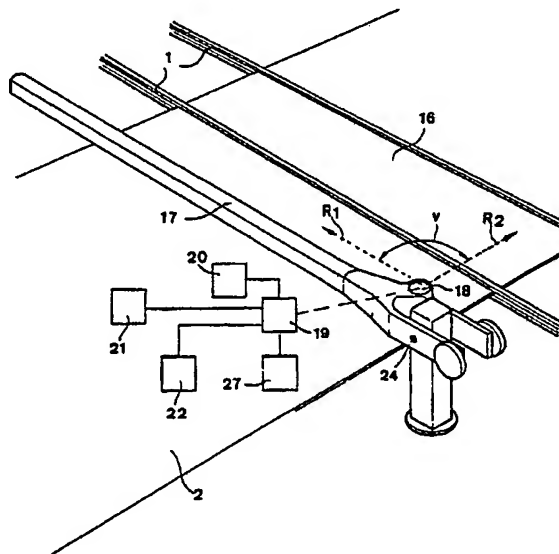




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/SE93/00071 (22) International Filing Date: 1 February 1993 (01.02.93) (30) Priority data: 9200265-8 31 January 1992 (31.01.92) SE 9203904-9 23 December 1992 (23.12.92) SE (71)(72) Applicant and Inventor: GUSTAVSSON, Kenneth [SE/SE]; Simborgarvägen 112, S-184 37 Åkersberga (SE). (74) Agents: BJERKÉN, Håkan et al.; Bjerkéns Patentbyrå AB, Box 304, S-801 04 Gävle (SE).	(81) Designated States: AT, AU, BB, BG, BR, CA, CH, CZ, DE, DE (Utility model), DK, DK (Utility model), ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG). Published <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>	

(54) Title: A DEVICE FOR SUPERVISING AN AREA



(57) Abstract

A device for supervising an area (16), in particular the crossing area between railway gates, in order to detect objects occurring in the area comprises a detector (18) adapted to transmit detection signals and receive their reflection caused by objects. The detector (18) is pivotably arranged in a reciprocal manner so as to transmit the detection signals in an angular area. The detector (18) may be a laser, the light of which forms the detection signals.

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10 A device for supervising an area

This invention is related to a device according to the precharacterizing part of the enclosed claim 1.

15 It can be established that today there are in practice no safe devices to supervise the crossing area, for instance the area between railway gates, at crossings between railways and roads so as to detect objects occurring in the crossing area, such as road vehicles and persons in order to avoid them being run into by trains.

20

Efficient devices for supervising are missing also in many other situations. It may then be the question of supervising of objects in the form of aeroplanes or other crafts or vehicles which are not bound to rails. Thus, the detection may have the purpose to supervise the
25 movement of these objects within the area in question. The device according to the invention may then be adapted to provide control or simplify such control of the object in question to a determined position for e.g. docking or give alarm in respect of undesired deviations between the actual position and the one desired.

30

There is no device for supervising areas which may be dangerous to set foot on which combines a reasonable cost with great flexibility and range. When docking for instance aeroplanes to a gate the positioning is critical since a collision often costs millions. The lead beacon systems
35 occurring today give very simple and insufficient information to the pilot.

OBJECT OF THE INVENTION

5 The object of the present invention is to provide a supervising device, with the assistance of which the deficiencies presented hereinabove may be reduced or eliminated.

SUMMARY OF THE INVENTION

10 The device according to the invention achieves the object aimed at by that defined in the characterizing part of claim 1. It becomes possible, by means of the solution defined, to use a relatively uncomplicated, pivotably arranged detector, the efficient detection area of which is obtained by processing the detection signals from the detector so that de-
15 limited distance values in the pivoting angular area are the basis for the assessment of the detection so that one in practice obtains an efficient detection area corresponding to the area to be supervised, but not more. In other words one can accordingly, by design, adjustment or programming of the signal processing unit, achieve an accurate definition of the
20 extent of the supervising area by causing the distance value concerning the detection range to vary in the pivoting angular area. For example, the supervising area may be caused to be substantially rectangular, which normally would be desirable when supervising crossings between railways and roads.

25 The device according to the invention involves great advantages since it can easily be adjusted to the most varying supervising conditions with the same hard ware. Furthermore, the device according to the invention involves the advantage that it, besides instantaneous determination of
30 position also can sense speed and speed gradients. This is of considerable value for instance in application for supervising the docking area between aeroplanes and a gate. It is pointed out that the device in such a case does not require any adjustment of the aeroplane or the object whatever. Instead, information detected by the detector may be indicated on a
35 display unit, which may be of the table type or viewing screen type so that the operator or pilot obtains needed information about the position

of the aeroplane during docking by viewing the same. The signal processing unit may then be designed to indicate, on the display unit, an optimal position for the aeroplane at each given point of time.

- 5 The device according to the invention may without change be used for most installations within railway crossings, aeroplane dockings and area supervision with a hard and soft ware which is substantially identical.

Specific developments of the invention are defined more closely in the
10 dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the enclosed drawings, a more specific description of
15 embodiments of the invention cited as examples will follow hereinafter.

In the drawings:

Fig 1 is a perspective view illustrating a passage preventing gate at a
20 crossing between a railway and another road, a block diagram also being included;

Fig 2 is a view of the gate illustrated in Fig 1 viewed from above; and

25 Fig 3 is a detail view of the gate illustrated in Fig 1 as viewed from the side adjacent to the railway tracks.

DETAILED DESCRIPTION OF AN EMBODIMENT FOR RAILWAY CROSSINGS

30

A crossing between a railway 1 and another road 2 is illustrated in Fig 1. This latter road does not comprise any tracks as does the railway 1 but is intended to be traversed by vehicles provided with rubber wheels, i.e. the path of the road 2 is flat or plane.

35

The term "railway" includes ways and tracks for track bound vehicles such as trains, commuter trains, rail cars, trains for underground railways and so on.

- 5 The device illustrated in Figs 1-3 is adapted to supervise the crossing area 16, e.g. the area between railway gates 17, at crossings between a railway 1 and another road 2 of the nature already described in order to detect objects which occur in the crossing area 16 and which form a hindrance to the train or the like moving on the railway 1.
- 10 A detector is diagrammatically indicated with 18 in Figs 1 and 2. This detector is adapted to transmit detection signals and to receive their reflection caused by objects. The detector is pivotably arranged reciprocally so as to transmit the detection signals in an angular area. This
- 15 angular area is indicated with the angle v in Figs 1 and 2. More specifically, this angular area is delimited by a direction R1 extending substantially parallel to the gate 17 and a direction R2 extending substantially perpendicularly to the gate.
- 20 The detector 18 is in a manner diagrammatically indicated in Fig 1 connected to a signal processing unit 19 adapted or adjustable/programmable to process signals obtained from the detector 18 in order to delimit the detection of foreign objects to a distance value varying in the pivoting angle area v in order to achieve an efficient de-
- 25 tection area corresponding to the crossing area to be supervised. Crossing areas are in practice normally substantially rectangular. The efficient detection distance along the direction R1 may substantially correspond to the width of the road 2 or for instance one half thereof in case there is a further detector for the other road half, whereas the efficient detection
- 30 distance along the direction R2 normally is the width of the crossing area 16 transversely to the railway 1.
- In order to achieve the detection area aimed at, there is conducted in the signal processing unit 19 such a signal processing that the efficient de-
- 35 tection distance will vary whereas the detector is pivoted between the directions R1 and R2 such that the supervising device only reacts if, within

this efficient detection area, some object, for instance a vehicle or a person, would occur, which at that point of time should not rightly be there. Thus, this means that the control unit 19 is co-ordinated with the gate operating arrangement or otherwise receives information as to when trains are in a dangerous neighbourhood and activates the detection operation not until there is a real danger.

The signal processing unit 19 is adapted to, on detection of objects in the crossing area,

10

a) control an operating arrangement 20 to raise the gate 17 and/or

b) control a signal arrangement 21 to indicate to an approaching train that objects are in the crossing area and/or

15

c) control an automatic train stop arrangement 22 to stop the approaching train.

Furthermore, it is preferred that the signal processing unit 19 is adapted or adjustable to react only to objects having an area exceeding a certain value. This area value should be adjusted to exceed that which could be expected from a human being but such that reactions are not unnecessarily given to small animals.

Furthermore, it is preferred that the signal processing unit 19 is arranged or adjustable to give alarm or react only if an object has been detected a certain number of times in sequence or during a certain time period. This has the purpose to avoid reaction or alarm being given in case an object rapidly passes the supervising area.

30

A combination could then be provided in the sense that the signal processing unit 19 could be arranged or adjustable to react or give alarm only if the same size of an object has been detected at the same place a certain number of times in sequence or during a certain time period. The desired control operation or alarm, including for instance a signal directly to the approaching train, is then initiated.

35

Advantageously, the detector 18 comprises a laser, the light of which forms the detection signals.

- 5 As also appears from Figs 1 and 2, the detector may be arranged on the gate 17 itself for fencing off the crossing area 16.

Fig 3 illustrates somewhat more in detail that the detector 18 may be arranged in a cassette 23, which in its turn is receivable in a compartment 10 25 arranged in the gate 17 in the area of the pivoted suspension 24 thereof. The detector 18 with its sweep motor and electronics is, accordingly, mounted within said cassette 23, which suitably may consist of a transparent plastics tube. This plastics tube is sealed in a moisture tight and dust tight manner at the top and at the bottom. The cassette 23 15 is mounted and secured in the compartment 25 and then the compartment is sealed with a closing cover. The electrical connections occur with particular moisture protected connectors with quick coupling. In a wall of the compartment 25 there is arranged a window 26, thorough which the detection signals of the detector pass.

20

The cassette 23 enables rapid exchange on repair and maintenance.

It has been described hereinabove that the detector 18 is arranged at the gate 17 itself. This is an advantageous design in the sense that there will 25 not be needed any particular carrying devices for the detector and, furthermore, the movements of the gate 17 will have the consequence that the vibrations occurring will keep the signal exits of the detector free from hindering snow etc. However, it should be emphasized that the detector 18 could also be arranged at a carrier, for instance in the form of a 30 post or the like secured relative to the ground, separate from the gate 17.

It is preferred that the signal processing unit 19 is also connected to a display device 27 to indicate the position of a detected object by means of said unit. The signal transmittance between the signal processing unit 35 19 and the display unit 27 may be wireless or may otherwise occur by means of long cables so that appropriate supervising personnel may

study the display unit and follow the development of events. In case of a railway application, the display unit 27 could also be provided in a locomotive so that the driver could see whether any foreign objects would be present in the area supervised.

5

In the case according to the example, the detector 18 is intended to be pivotable or rotatable about a substantially vertical axis in order to cover the supervising area 16. In order to increase the detection width vertically during pivoting in the angular area v , the detector could be
10 pivotable about a further axis, which is suitably substantially horizontal. The device could then be such, that the detector pivoted vertically in an oscillating movement whereas it moved in the angular area v .

DESCRIPTION OF ALTERNATIVE EMBODIMENTS

15

The device according to the invention is also suitable to be used for other detection purposes. It could for instance be the question of detection of the position of aeroplanes or other crafts within specific zones, for instance position determination of aeroplanes within docking zones at a
20 gate, the purpose of the device according to the invention being to simplify guidance of the aeroplane or the object into the desired end position. The device according to the invention then operates so as to be capable of detecting also other objects located at the wrong place and stop the docking or the like in case of risk for collision.

25

The device according to the invention may, besides, by suitable design of the signal processing unit 19 be made to sense, itself, normal situations by "remembering" the surroundings and thereby only give alarm at specified deviations. This involves a great flexibility in the installation
30 and a possibility to see small objects in complex environments.

The features and designs described hereunder are in certain cases specifically useful for other applications but may, on the other hand, be possible in certain cases to apply in connection with the device already
35 described for supervising the crossing area between railways and other roads. In the following other applications will be described while using,

as far as possible, the same designations used in Figs 1-3. Thus, the difference is that the area 16 which is to be supervised in the situations discussed hereunder is thought to be other areas than railway crossings.

- 5 It is preferred that the signal processing unit 19 is adapted to store information obtained from the detector 18 about stationary objects located in the area and distinguish information thereabout from information concerning objects movable in the area. The processing unit 19 is then preferably adapted to give alarm and/or indication only in connection with
10 movable objects in the area 16.

- As already mentioned, a display unit 27, suitably of the table type or viewing screen type, is preferably connected to the signal processing unit 19. The latter is then adapted to indicate, by means of the display unit,
15 the position of detected objects with respect to angle and distance and suitably compare this position with the desired position of the object, differences between the positions being useful for control values for directing the object to the desired position.

- 20 As has already been pointed out, the device may be adapted for detection of objects in the form of aeroplanes or other crafts or vehicles which are to be stopped in a desired or known position and have the possibility to follow a certain path or course.

- 25 The signal processing unit 19 is adapted to show, on the display unit 27, information about the lateral position of the object and/or distance and/or velocity relative to a known point and, possibly, to start an alarm when there are excessive deviations relative to desired values.

- 30 The detector 18 and signal processing unit 19 may be arranged to measure the distance to one or more objects and to use the reflection indicative of the most remote object if there are more in the light lobe, and to consider adjacent reflections as disturbances and eliminate the same electronically.

35

The signal processing unit 19 is preferably arranged to calculate the area and/or shape of the object and use the information thereabout to treat different objects differently as a consequence of size and/or shape and to disregard, as far as signal processing is concerned, those which fall outside certain programmed sizes and/or shapes.

The detector 18 is suitably arranged to search for the part of the detected object which is the closest and then follow that part and use it as a control point. The signal processing unit 19 and the detector 18 are arranged to sense, at the same time, undesired objects on the wrong place and present information thereabout by means of the display unit 27, the unit 19 being capable of alarm so as to, for example, interrupt a docking of an aeroplane or other vehicle when there is a risk for problems.

The designs described may of course be modified in several ways within the scope of the inventive concept.

Claims

1. A device for supervising an area (16) in order to detect objects occurring in the area, **characterized** by a detector (18) adapted to
5 transmit detection signals and to receive their reflection caused by objects, that the detector (18) is reciprocally pivotable to transmit the detection signals in an angular area (V), and that the detector is connected to a signal processing unit (19) adapted to process signals obtained from the detector so as to limit the detection of foreign objects in the pivoting
10 angular area as far as distance is concerned in order to obtain an efficient detection area corresponding to the area (16) to be supervised.
2. A device according to claim 1, **characterized** in that the detector (18), apart from its pivotability about a first axis, is pivotable about a further
15 axis.
3. A device according to claim 1 or 2, **characterized** in that the signal processing unit (19) is adapted to store information received from the detector (18) concerning immovable objects present in the area and to
20 distinguish information thereabout from information concerning objects movable in the area.
4. A device according to claim 3, **characterized** in that the signal processing unit (19) is adapted to give alarm and/or indication only in
25 respect of objects being movable in the area (16).
5. A device according to any preceding claim, **characterized** in that the signal processing unit (19) is connected to a display unit (27) to indicate, by means of said display unit, the position of a detected object with re-
30 gard to angle and distance and preferably compare this position with a desired position of the object, differences between the positions being used as control parameters for directing the object to a desired position.
6. A device according to any preceding claim, **characterized** in that it is
35 adapted for detection of objects in the form of aeroplanes or other vehi-

cles which are to stop in a desired or known position and which should have the possibility to follow a certain path or course.

- 5 7. A device according to claim 1, characterized in that the signal processing unit (19) is adapted to provide information concerning the position of an object in the detection area and indicate such information corresponding to the difference between a real and a desired position by means of a display unit (27), e.g. of a table like type.
- 10 8. A device according to claim 7, characterized in that the signal processing unit is adapted to show, on the display unit (27), information as to the lateral position of the object and/or the distance and/or the speed of the object relative to an known point and, possibly, to produce an alarm in case of excessive deviations relative to desired values.
- 15 9. A device according to any preceding claim, characterized in that the detector (18) and the signal processing unit (19) are adapted to measure the distance to one or more objects and to use the reflection indicating the mostly remote object if there are more objects in the signal lobe and
- 20 to consider adjacent reflections as disturbances and electronically eliminate the same.
10. A device according to any preceding claim, characterized in that the signal processing unit (19) is adapted to calculate the area and/or shape
- 25 of the object and to use information thereabout so as to treat different objects in a different manner as a consequence of size and/or shape and to disregard, as far as signal processing is concerned, those falling outside certain sizes and/or shapes programmed into the unit.
- 30 11. A device according to any preceding claim, characterized in that the detector (18) is adapted to search for the part of the detected object being the most adjacent one and to thereafter follow that part and use it as a control point.
- 35 12. A device according to any of claims 7-11, characterized in that the signal processing unit (19) and the detector (18) are adapted to detect, at

the same time, undesired objects being at the wrong place, at the same time as information thereabout is presented by means of said display unit, alarm being produceable on said detection so as to, for example, interrupt docking of an aeroplane or other vehicle when there is a risk for problems.

13. A device according to any preceding claim, to supervise the crossing area (16), e.g. the area between railway gates, in crossings between railways and other ways so as to detect objects present in the crossing area, characterized in that the signal processing unit (19) is arranged or adjustable or programmable to process signals obtained from the detector to delimit the detection of foreign objects to a distance value varying in the pivoting angular area in order to obtain an efficient detection area corresponding to the crossing area (16) to be supervised.

14. A device according to claim 13, characterized in that the signal processing unit (19) is adapted to, on detection of objects in the crossing area,

a) control a gate operating arrangement (20) to raise possibly occurring gates and/or

b) control a signal arrangement (21) to indicate to an approaching train that objects are in the crossing area and/or

c) control an automatic train stop arrangement (22) to stop approaching trains.

15. A device according to any preceding claim, characterized in that the detector (18) comprises a laser, the light from which forms the detection signals.

16. A device according to any of the claims 13 and 14, characterized in that the detector (18) is arranged at a gate (17) for closing off the crossing area.

17. A device according to claim 16, **characterized** in that the gate comprises a compartment (25) provided in the gate in the area of the pivotable suspension (24) of the gate, the detector (18) being receivable in said compartment.

5

18. A device according to any of claims 13 and 14, **characterized** in that the signal processing unit (19) is adapted or adjustable to react only to such objects which have an area exceeding a certain value.

10 19. A device according to any preceding claim, **characterized** in that the detector (18) is a laser based distance meter of a triangulation type or a meter based upon the velocity of light as a distance reference or a meter detecting within certain distance ranges in that the detector system is masked so that it does not see outside the desired areas.

15

20. A device according to any preceding claim, **characterized** in that one or more objects having a known position in the detection area are used to control the operation of the detector (18) and the signal processing unit (19) and to calibrate the distance in absolute or relative measurements.

20

21. A device according to any preceding claim, **characterized** in that means are provided to activate, on occurrence of a stop signal or alarm, a visible laser light source emitting light straight towards the one to be notified/warned, said light source preferably having a good directability and a surface effect adjusted so as to be undangerous.

25

22. A device according to any preceding claim, **characterized** in that the sweep of the laser beam is controlled by a stepping motor in one or two axes and that the dislinearity in angle of the stepping motor is linearized or compensated in a soft ware.

30

23. A device according to any preceding claim, **characterized** in that means are provided to cause the measuring lobe, on following of a movable object, to sweep over a larger surface so as to see the most adjacent part of the object and to thereafter decrease the sweeping angle to an

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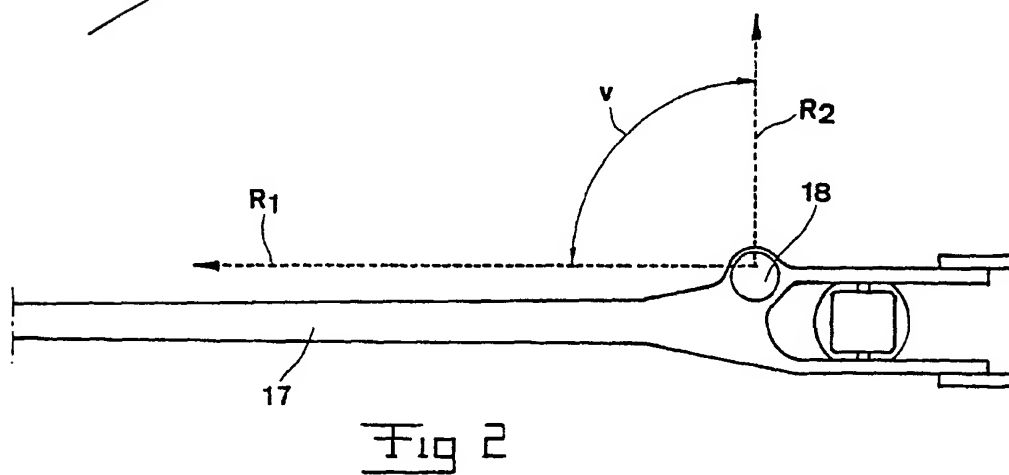
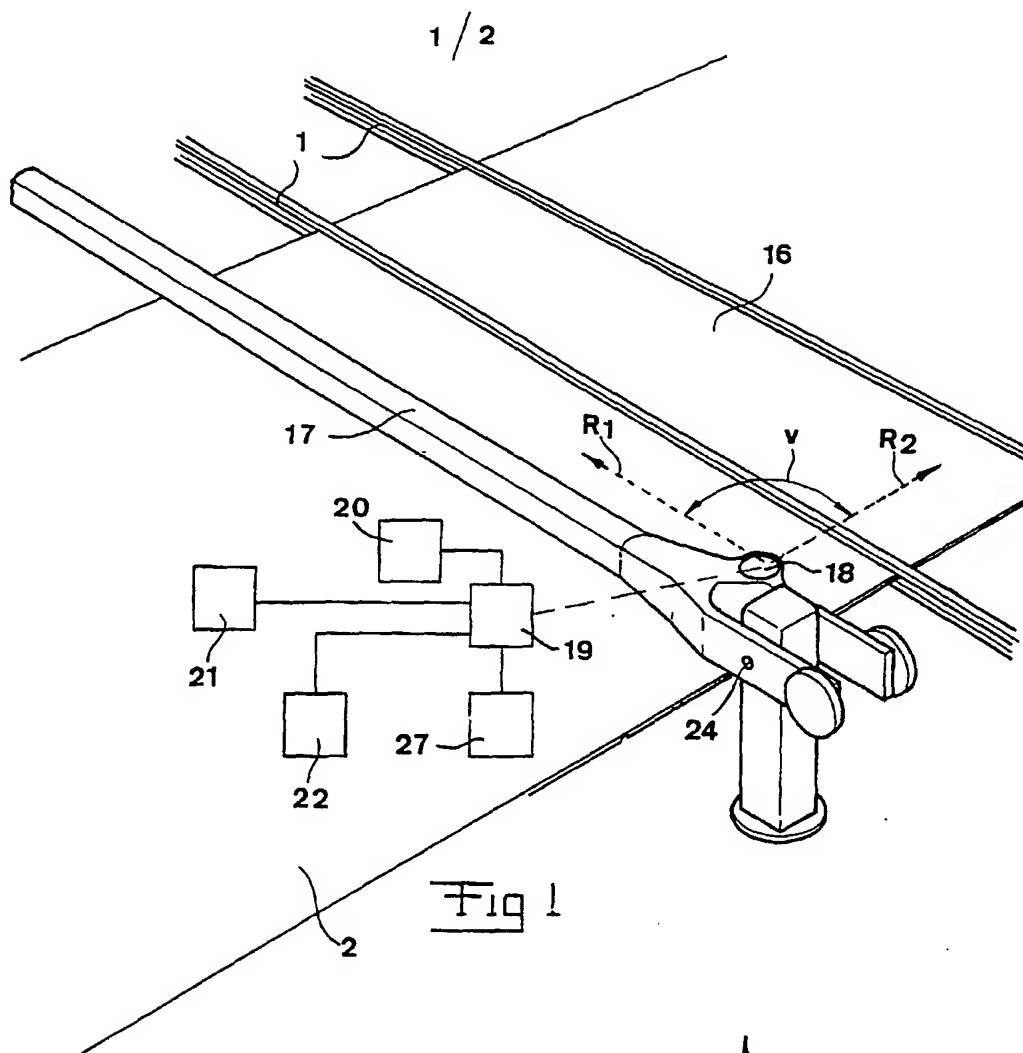
oscillation only about this most adjacent part so as to make the sweeping angle smaller and allow a larger sweeping frequency.

5 24. A device according to any preceding claim, **characterized** in that the detection system uses the doppler principle for measuring the velocity of the object.

10 25. A device according to any preceding claim, **characterized** in that the detection ray has a parking location with a known position used for calibration and operational check of the detector and the signal processing unit and that there is, in this position, a receiving detector indicating the measuring lobe to be in a correct position.

15 26. A device according to any preceding claim, **characterized** in that means are provided to give alarm for erroneous adjustment of the device by measuring the geometry of the object and compare the same with what is expected to be there and by indicating deviations between these different values.

20 27. A device according to any preceding claim, **characterized** in that it is adapted to measure certain dimensions on the aeroplanes on docking and to initiate alarm and stop the docking on excessive deviations relative to expected values of such dimensions.



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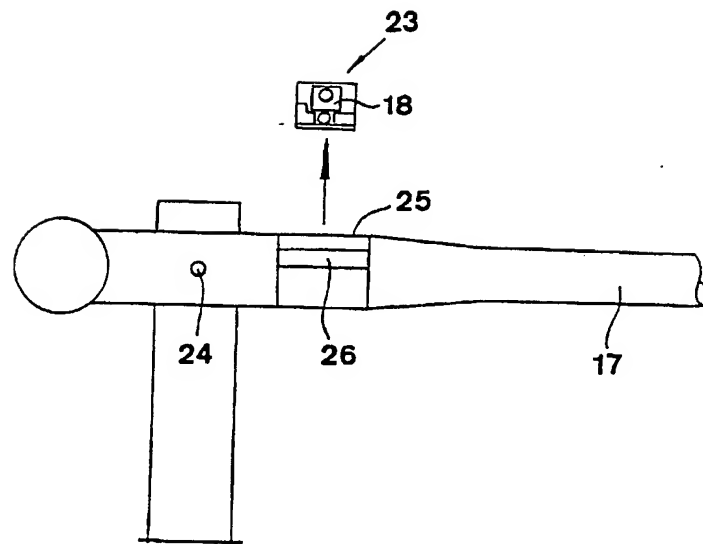


Fig 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 93/00071

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: G01S 13/56, B61L 29/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: G01S, G08G, B61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4995102 (YUUJI ICHINOSE ET AL), 19 February 1991 (19.02.91), see the whole document	1,2
Y	--	2-27
X	EP, A1, 0188757 (SIEMENS AKTIENGESELLSCHAFT), 30 July 1986 (30.07.86), column 1 - column 3	1
Y	--	2-27



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

3 May 1993

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06 -05- 1993

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 93/00071

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Patent Abstracts of Japan, Vol 13, No 322, P-902, abstract of JP, A, 1-88899 (TOSHIBA ELECTRIC EQUIP CORP), 3 April 1989 (03.04.89)	1
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INTERNATIONAL SEARCH REPORT
Information on patent family members

31/03/93

International application No.

PCT/SE 93/00071

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		JP-A- 50001700	09/01/75
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DE-A1- 2401043	17/07/75	NONE	
DE-C2- 2656706	10/04/86	NONE	